Volume 5, Issue 10, October-2015 ISSN: 2277 128X
International Journal of Advanced Research in Computer Science and Software Engineering
Research Paper
Available online at: www.ijarcsse.com

Object Based Image Retrieval Using LBP and Fuzzy Clustering Method

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Abstract: ***Content based image retrieval, in the last few years has received a wide attention. Content Based Image Retrieval (CBIR) basically is a technique to perform retrieval of the images from a large database which are similar to image given as query. CBIR is closer to human semantics, in the context of image retrieval process. CBIR technique has its application in different domains such as crime prevention, medical images, weather forecasting, surveillance, historical research and remote sensing. Here content refers to the visual information of images such as texture, shape and colour. Contents of image are richer information for an efficient retrieval in comparison to text based image retrieval. This paper presents a review on various ways of content based image retrieval along with a proposed CBIR system based on LBP and FCM.***

Keywords:-LBP, FCM, Content based Image Retrieval, Image Retrieval

I. INTRODUCTION

Content-based image retrieval (CBIR) has become an important research area in computer vision due to huge digital image collections on World Wide Web. There are collections of images from art museums, medical institutes, and environmental agencies, to name a few. In the commercial sector, companies have been formed that are making large collections of photographic images of real-world scenes available to users who want them for illustrations in books, articles, advertisements. The largest of these companies have collections of over a million digital images that are constantly growing bigger. Incredibly, the indexing of these images is all being done manually–a human indexer selects and inputs a set of keywords for each image. Each keyword can be augmented by terms from a thesaurus that supplies synonyms and other terms that previous users have tried in searches that led to related images. Keywords can also be obtained from captions, but these are less reliable. Content-based image retrieval research has produced a number of search engines. The main reason is that most CBIR systems require an example image and then retrieve similar images from their databases. Real users do not have example images; they start with an idea, not an image. Some CBIR systems allow users to draw the sketch of the images wanted. Such systems require the users to have their objectives in mind first and therefore can only be applied in some specific domains, like trademark matching, and painting purchasing.

II. TECHNIQUES USED IN IMAGE RETRIEVAL SYSTEM

• Several content based image retrieval methods have been proposed to enhance the image retrieval.To improve overall retrieval rate and growth. And principle objective of image retrieval is to process an image so that result is more accurate ascompared to previous algorithm.

2.1 Local Binary Patterns

The original LBP operator labels the pixels of an image with decimal numbers, which are called *LBPs* or *LBP codes* that encode the local structure around each pixel. It proceeds thus, as illustrated in Fig. 1: Each pixel is compared with its eight neighbours in a 3 × 3 Neighbour -hood by subtracting the centre pixel value; the resulting strictly negative values are encoded with 0, and the others with 1. For each given pixel, a binary number is obtained by concatenating all these binary values in a clockwise direction, which starts from the one of its top-left neighbour. The corresponding decimal value of the generated binary number is then used for labelling the given pixel. The derived binary numbers are referred to be the LBPs or LBP codes.

One limitation of the basic LBP operator is that its small3 × 3 neighbourhood cannot capture dominant features with large-scale structures. To deal with the texture at different scales, the operator was later generalized to use neighbourhoods of different sizes [1].A local neighbourhood is defined as a set of sampling points evenly spaced on a circle, which is cantered at the pixel to be labelled, and the sampling points that do not fall

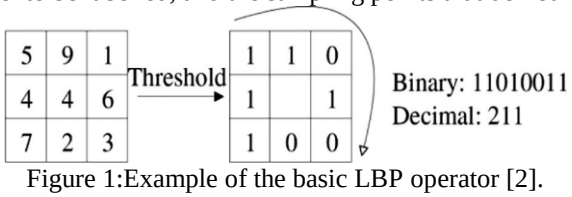

Figure 1:Example of the basic LBP operator [2].

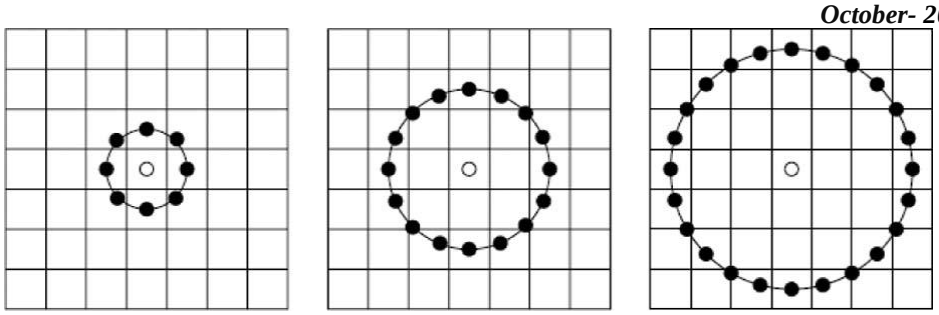

Figure 2: Examples of the ELBP operator[3]. The circular (8, 1), (16, 2), and(24, 3) neighbourhoods

2.2 fuzzy method of clustering

As an important data processing technique, clustering has been widely utilized in a variety of fields, such as pattern recognition, image processing, and data mining. It attemptsto organize un labelled input vectors into clusters or "natural groups" such that data points within a cluster are more similar to each other than those belonging to different clusters, i.e., to maximize the intra cluster similarity while minimizing the inter class similarity. Clustering algorithms can be generally classified into the following categories: hierarchical, partition-based,density-based, grid-based, and model-based clustering algorithms. Among them, the partition based clustering algorithms which partition the objects withsome membership matrices were most widely studied. Based on their way in handling uncertainty in data, thepartition-based clustering algorithms can be categorized into probabilistic and fuzzy clustering algorithms. In fact, the oftenusedhard or crisp clustering may be viewed as a special caseof the probabilistic and/or fuzzy clustering. Among the proposedfuzzy clustering algorithms, the fuzzy c-means (FCM) algorithm [4] is perhaps the most well known one. Most of the newly proposed fuzzy clustering algorithms originate from ite.g., possibility clustering [5] and fuzzy competitive learning[6]. FCM and its variants realize the clustering task for a dataset by minimizing an objective-function subject to some constraints,e.g., the summation of all the membership degrees ofevery data point to all clusters must be one. In [7], Höppner andKlawonn introduced a new way to constrain the membershipfunctions and proposed an FCM algorithm with improved fuzzypartitions, termed here as IFP-FCM for simplicity. IFP-FCM,in essence, rewards crisp membership degrees, so the modifiedversion seems less sensitive to noise and outliers. However, thefuzziness index m is only limited to two due to the introductionof the constraint membership function in[7]. Bedeckpointed out that FCM reduces to HCM when m = 1; as m tends to infinity, the centres of various groups in FCM are degraded into almost the centre of all of the data. It is obvious that the performancesof FCM in both circumstances are not satisfactory. Moreover, if the clusters in a data set have different densities, the performance of FCM may significantly depend on thechoice of fuzziness index m. Hence, a good choice of m shouldbe adopted to follow the data distribution in the given data set.

III. LITERATURE SURVEY

This section involve Literature survey of various enhancement techniques used for image retrieval

Bhargavaet al [9] proposed an object based image retrieval algorithm for automatic image annotation. The proposed algorithm considers selection of objects with in an image. This object selection helps in dividing the image into different set of groups on the basis of present objects in an image. Thus, they do not need to extract the whole features from the images when a new image comes, rather they extract features from the objects and match those features against the different groups of images for the feature matching and effective retrieval based on object selection.

Ramona Chary et al. [10] introduced method to retrieve images which were based on similarity of size and shape of the image. Content Based Image Retrieval (CBIR) method created the need for proficient and intelligent schemes for classifying and retrieval of Images. One of the main advantages of CBIR is automatic retrieval process in place of the keyword-based approach. The CBIR technology has been used in several applications such as biodiversity information systems, medicine, digital libraries, crime investigation and Historical research. In this method, mean-mapping techniques have been used for the retrieval of images. Each image is converted into the gray form. The database contains threshold values and cluster mean values of more than 10000 images which are extracted using k-mean retrieval method. The query image is compared with the database image using mean mapping methods. The main aim of this work is to extract images with high-class similarity.

Patvardhan et al.[11] presents an efficient and simple approach for content based image retrieval. It utilizes the strength of multi resolution wavelet transform and edge histogram to extract colour and texture features. The wavelet based colour feature extraction scheme performs better than existing Mpeg-7 colour descriptors .Texture features are extracted from the edge histogram obtained from wavelet coefficients of the image at multiple resolution levels. The multi-resolution approach helps in collecting texture details from finer to coarser levels providing better performance than existing Mpeg-7 descriptors. The combination of the two features is trained and tested for Wang's image database. The results of retrieval are expressed in terms of precision and recall and compared with existing schemes. The results show the superiority of the scheme. The proposed scheme is fairly robust against several types of image alterations.

Zhang et al. [12] proposeda secure image retrieval method for cloud computing, which can guarantee the security of the image content while not sacrificing the retrieval performance. The method is implemented based on CBIR (content-based image retrieval) framework. To perform the secure image retrieval, three kinds of low-level image features are firstly extracted from images, including colour, texture and shape features. Locality preserving projections (LPP) is then applied to reduce the dimension of these image features. Secondly, image features are protected by the Paillierhomomorphic

encryption algorithm according to its homomorphic characteristics. Finally, similarity measurement is directly conducted between the encrypted features, and the top 12 similar images are treated as the retrieval results. The security and communication cost analysis of the proposed method are analyzed. Experimental results demonstrate that the proposed method can achieve the consistent retrieval results with the conventional CBIR method in the plaintext domain while providing adequate security.

JiameiNie et al. [13] usedspherical soft assignment (SSA)to enhance the image representation. Since SSA does not consider the gap between low level features and high-level semantics, relevance feedback has been applied in SSA. The first retrieval results are used as training samples. Users mark positive and negative cases and treat them as class labels of the training samples by SVM learning. Then a classifier is constructed that suits for user's query intention and with which all the images in the image database can be classified with the classifier. If images are divided into positive class, the distance between each image and the hyper plane is calculated. Then we will remark weights which are used to retrieve again. Results show that it can improve the precision of retrieval results.

Memon et al. [14] proposed a process of image refining retrieval result by exploiting and fusing unsupervised feature technique Principal component analysis (PCA) and spectral clustering. PCA algorithm is used for to remove the outliers from the initially retrieved image set, and then it uses Principal Component Analysis(PCA) to extract principal components of the feature values. Later on, feature values of each image are exhibited by a linear combination of these principal components. Spectral clustering analyses retrieval process by clustering together visually similar images.PCA and spectral clustering require manual turning of their parameters, which usually requires a priori knowledge of the dataset. To overcome this problem we developed a tuning mechanism that automatically tunes the parameters of both algorithms. For the evaluation of the proposed approach we used thousands of images from Flicker downloaded using text queries forwell-known cultural heritage monuments. The proposedmethod was performed and tested on a set of images fromvariant sceneries. Experimental results show the superiorperformance of this approach.

4. Presented method for retrieving images

An LBP and FCM based image retrieval system has been presented in this work which takes into account the colour and texture features of objects in the images. First of all colors has been reduced in original images by using color-quantizer which approximates the whole colormap into a considerable range of colours. After that local binary pattern and fuzzy method of clustering has been applied to get the texture and colour properties of input dataset. Same procedure has been followed for query image in which query object has been located in the image and LBP and FCM has been applied to get the texture and color features of the object. The histograms of LBP images has been compared with that of query image and a threshold has been set to consider a range according to that texture. Similarly color intensity values has been chosen in such a way from the query object that a particular color values that are found as popular colors in query image should also be located in the retrieved images. Results have been compared in terms of recall ratio and precision ratio to evaluate the performance of the proposed algorithm. Below is a flowchart for the proposed system.

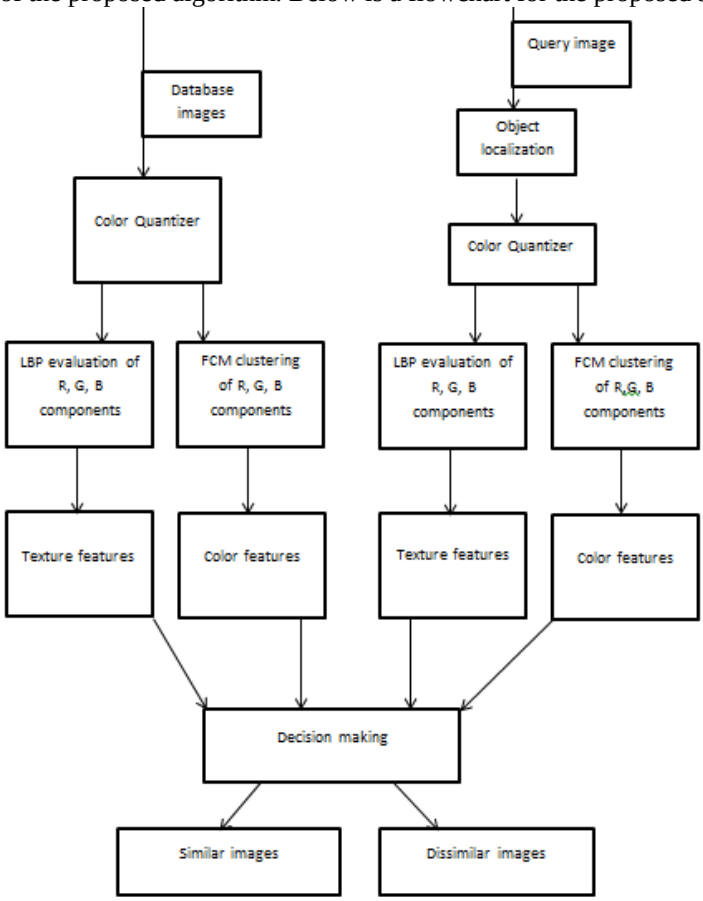

Figure 3: System design

IV. PRECISION & RECALL

Precision and recall are the basic measures used in evaluating search strategies. As shown in the first two figures on the left, these measures assume: There is a set of records in the database which is relevant to the search topic Records are assumed to be either relevant or irrelevant (these measures do not allow for degrees of relevancy). The actual retrieval set may not perfectly match the set of relevant records.

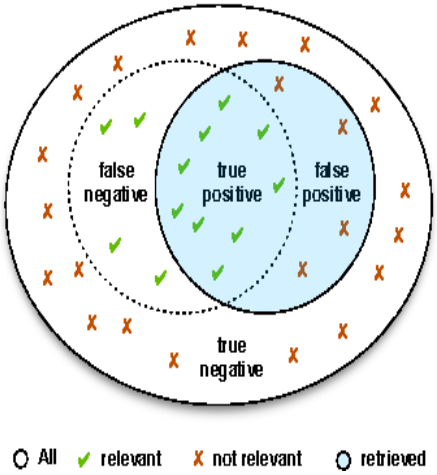

Figure 4: relevant records and irrelevant records

RECALL

$$\text{Recall}-\text{Ratio} = \frac{\text{TP}}{TP + FN}$$

$$\text{Precision}-\text{Ratio} = \frac{\text{TP}}{TP + FP}$$

Result description for query image as given below

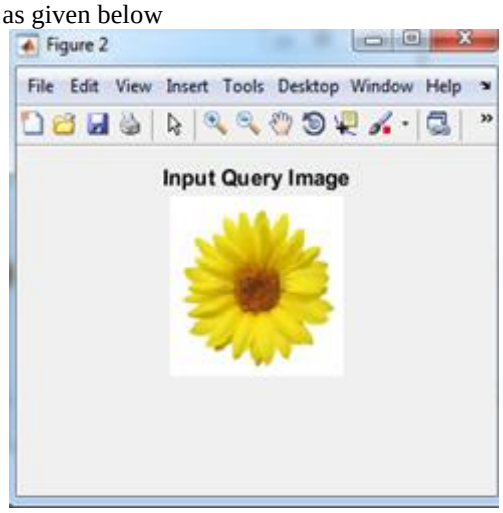

Figure 5: (a) input query image

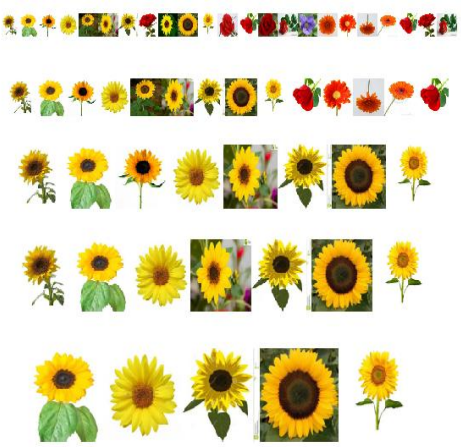

Figure 6: retrieved Results with different combination of color and texture parameter

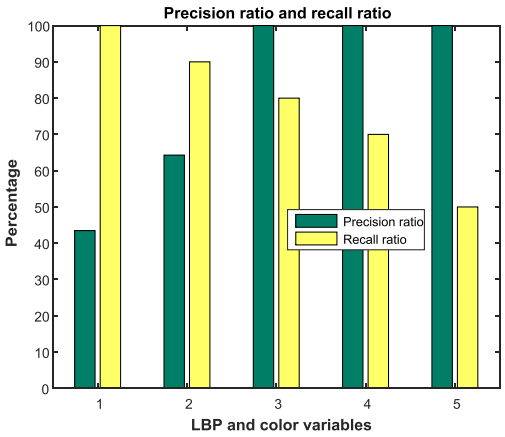

Figure7: Recall and precision ratio for input query image

Results show that as we increase the colour texture pattern, algorithm give high precision ratio but there is decrease in recall ratio for some images. The algorithm has been tested on number of input query images on flower dataset. As shown in the above images it has been concluded that when we increase the colour and texture parameter values there is increase in precision rate but decrease in recall rate. The retrieval results depend upon the human perception as only observer can define the necessity of retrieved images. We have evaluated the performance of the proposed algorithm by changing the colour and texture parameters. As one need more similarity of query image with the database images he has to increase the colours needed in that particular template.

V. CONCLUSION

In this paper, LBP and FCM based CBIR system has been presented. It is concluded that a lot of work is required to be done in this area. Presented techniques shows very low accuracy hence cannot be used in the real world applications. Existing techniques shows good results only on small dataset but accuracy decreases considerably on large dataset. Although this area has been explored for decades, there is still a very large scope for achieving the accuracy of human visual perception in distinguishing images. To achieve more accurate results, we have presented texture and intensity based image retrieval system.First of all colours has been reduced in original images by using color-quantizer which approximates the whole colour map into a considerable range of colours. After that local binary pattern and fuzzy method of clustering has been applied to get the texture and colour properties of input dataset. Then query image has been put into system from which texture and color features are extracted. Then different combinations of texture and colour thresholds are tested to get the similar images in the database. Experimental results show that different image sets can be retrieved depending upon the requirement of the observer by changing the threshold of the parameters.

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